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Introduction

Frequently I am asked, "how does this growing season compare to previous years?" In reality, there are certain generalizations that can be drawn regarding the similarities among all growing seasons. Rainfall, temperatures, weeds, insects, diseases, frost, all seem to have some degree of impact on every growing season. As I review the conditions of the 1999 growing season, there are many similarities to what was experienced in the 1998 growing season. Too cool, too wet, too warm, too dry, high winds, early frost... all played significant roles in influencing the 1999 crop. However, given all the adverse conditions that occurred throughout the season, the crop still managed to "weather" them pretty well and yields have been remarkably good considering all factors. Let's take a look at what happened during the 1999 growing season and attempt to explain why things turned out the way they did.

The October Crop Report estimated Iowa corn and soybean yields at 150 and 48 bu/ac, respectively. For corn, this represents a five-bushel increase over lasts year's state average yield of 145 bu/ac. One can expect these numbers to be adjusted somewhat by subsequent reports. The yield relationship between corn and soybean varies between regions and is a reflection of the variation in growing season in the different parts of the state.

Yield estimates are presented by Crop Reporting District in Table 1. Yield variability is the result of many factors. The major negative factors in 1999 were heavy rains, cool temperatures in May and June, limited rainfall and warm temperatures in July and August, weeds, stalk rots, early frost, etc. The importance of each varied greatly depending on region of the state.

Table 1. Iowa corn yield in bushels per acre (USDA-NASS).

District	1998	1999*
	----------Yield Per Acre (bushels)----------	
Northwest (NW)	153.1	157
North Central (NC)	149.9	154
Northeast (NE)	152.1	159
West Central (WC)	138.5	144
Central (C)	145.5	152
East Central (EC)	152.0	161
Southwest (SW)	135.6	139
South Central (SC)	123.5	131
Southeast (SE)	129.5	129
STATE	145	150

*Estimated

Early Season

Following a rather mild and dry winter, March entered with a fairly light snow cover and a fairly shallow frost line. Most of the March precipitation came in the form of snow that fell early in the month. March temperatures were very close to normal, yet, did not exhibit the wide fluctuations that are typical for the month. The latter half of the month proved to be warmer and drier with some fieldwork beginning in isolated areas across the state. Fertilizer applications were slightly over half complete (including fall applications) by the first of April. A few producers took advantage of the warm, dry conditions in late March and actually got some corn planted (as early as I can remember in Iowa). With below average snowfall for the winter, and dry, windy conditions in the early spring, inadequate subsoil moisture concerns were being expressed. Subsoil moisture reserves mostly were in the adequate to short range for much of the state going into the planting season. As we will see later, subsoil moisture will serve as a key factor in carrying the corn crop through the pollination period and into early grain fill. The warm and dry conditions of late March quickly gave way to cooler, wetter conditions in April and farmers were beginning to get anxious to get fieldwork underway. Table 2 provides rainfall information for the current growing season.

Table 2. 1999 Iowa regional crop season precipitation in inches from April 1 to date indicated (cumulated and departure from average).*

District	May 2	June 7	July 6	August 3	September 7	October 4
NW	5.4/2.5	10.1/3.1	15.0/4.1	18.6/4.4	20.0/1.5	20.6/-0.8
NC	7.0/3.6	15.3/7.3	20.6/8.4	27.8/11.7	30.1/9.4	31.7/7.8
NE	6.2/2.6	14.3/6.2	18.6/6.5	26.9/11.0	31.0/10.2	32.8/6.6
WC	7.5/4.3	12.8/4.7	18.4/6.3	21.7/6.3	26.4/6.8	26.8/4.0
C	5.9/2.3	12.6/4.2	17.8/5.0	21.1/4.6	25.1/4.0	26.5/2.2
EC	5.8/2.1	11.2/3.0	16.0/3.6	19.2/3.0	22.2/1.1	24.7/0.2
SW	7.8/4.3	15.1/6.5	20.3/7.5	23.3/6.6	28.3/6.8	30.3/5.1
SC	5.7/1.8	12.0/3.3	15.9/3.0	18.9/2.1	22.6/1.1	25.2/-0.2
SE	5.4/1.5	10.9/2.4	14.3/2.0	16.4/0.0	19.5/-1.4	23.5/-1.4

*Adapted from Iowa Agricultural Statistics Reports.

The dry weather pattern that had prevailed over much of the state since early March came to an abrupt end with the coming of April. Rainy, cool conditions rolled into Iowa early in the month and persisted throughout much of the month. Weekly rainfall totals, in some cases, were two to three times the average amounts. The cool, wet conditions were all too familiar to many farmers across the state. Soil temperatures slowly crept into the upper 40s to low 50s across much of the state, but the wet conditions left farmers anxious to get a good start on fieldwork. Table 3 provides growing degree information for the 1999 growing season.

Table 3. 1999 growing degree days from May 1 to dates indicated (cumulated and departure from average).*

District	May 31	July 5	August 1	September 5	October 3
NW	344/16	981/-31	1669/-16	2372/-19	2661/-46
NC	338/19	999/14	1695/69	2364/67	2647/43
NE	359/40	1040/66	1736/123	2410/112	2700/85
WC	363/6	1044/-45	1770/-21	2509/-36	2815/-84
C	353/6	1051/-10	1770/23	2478/1	2774/-51
EC	386/43	1106/55	1826/94	2538/75	2846/31
SW	364/-12	1087/-59	1837/-50	2620/-75	2941/-145
SC	363/-13	1099/-47	1851/-41	2640/-59	2958/-133
SE	442/59	1242/84	2017/124	2841/147	3207/111

*Adapted from Iowa Agricultural Statistics Reports.

Corn planting got off to a sluggish start (Table 4), and in many cases, field conditions were less than ideal and farmers were forced to work only in drier fields or around wet spots. By the end of the month, there were numerous reports of rivers overflowing their banks and water standing in bottomlands. Soils across much of the state were nearing saturation levels. Topsoil moisture conditions rated nearly 60% in the surplus category for the state. Subsoil moisture levels rated 35% surplus. April exited with a statewide precipitation total of 6.27 inches, which marks it as the wettest April in 127 years of state recordkeeping.

Table 4. 1999 Iowa corn planting progress by week for various crop reporting districts.*

	Percent of corn planted by					
District	April 25	May 2	May 9	May 16	May 23	May 30
NW	4	17	78	91	97	100
NC	2	18	91	93	95	98
NE	5	18	76	88	91	95
WC	2	11	66	89	90	98
C	2	17	81	92	93	99
EC	2	7	70	85	90	99
SW	3	8	33	63	81	95
SC	1	8	33	42	49	84
SE	2	8	25	56	59	95
State**	3/10	14/37	66/63	83/80	88/91	97/95

*Adapted from Iowa Agricultural Statistics Reports.
**Percent complete 1999/percent complete normal.

Early May began on a warmer, sunnier note and farmers were able to get some fieldwork done. Most fieldwork, however, was restricted to hilltops and well-drained areas as the bottomlands remained quite wet. After a relatively slow start to corn planting, the warmer and drier conditions opened up a window of opportunity for producers to get some corn in the ground. Consequently, over 50% of the state's corn acres were planted in a little over a week (Table 4). Recent memories of wet planting seasons were too fresh in many farmers' minds to allow any available planting window to pass by. Without doubt, some planting progressed when seedbed conditions were less than optimum.

Mid-May brought a return to the wet weather pattern that had plagued the state since early April. Heavy thunderstorms rumbled across the state dumping torrential rains over much of northeast Iowa. In addition, large hail was reported across the state and tornadoes were reported in at least seven counties in southwest Iowa. The heavy rains caused rivers to swell and localized flooding was reported in several northeast Iowa counties. Consequently, serious soil erosion resulted as well as ponding in most fields. Replanting was being considered on most acres and in some cases, producers were considering planting soybeans rather than corn if the soils didn't dry soon. Many producers began comparing the wet conditions to those of the 1993 season, with some producers believing the 1999 season was worse than what had been experienced in 1993. The cool, damp conditions also hampered germination and emergence of that portion of the crop that had been planted and producers across the state were hoping for some warmer, drier weather. Many fields experienced crusting which ultimately resulted in uneven emergence accompanied by a general lack of vigor in the corn plants. Warmer weather finally arrived by the month's end triggering a rebound in crop growth as well as further advancement of the planting progress, primarily in the northern half of the state. Sections of extreme southern Iowa remained hampered by the wet conditions, especially in south central Iowa. As a result of these wetter than normal conditions, estimates revealed that approximately 6-7% of the corn acreage had been or was intended to be replanted. In some cases, replanted fields were repeatedly inundated by excessive rains that resulted in additional crop losses and/or replanting operations. By the end of May, the USDA had reported that 69% of the Iowa corn crop rated in the "good" and "excellent" categories. This compared to 79% for Illinois, 84% for Indiana, and 62% for Minnesota.

The month of June was ushered in with some warmer and drier conditions, but they were short-lived with a return to cooler and wetter conditions by mid-month. Rainfall events came quickly and in large quantities, resulting in additional ponding and soil erosion in many parts of the state. Soil crusting continued to cause problems with emergence, while emerged plants began to exhibit the symptoms from the stresses resulting from the cool and wet conditions. Replanting continued in fields where possible, but some producers were faced with the realization that a few fields would not get planted at all. Weed control became an issue, also, as the wet conditions forced producers to delay herbicide applications and cultivation. Corn rootworms feasted in many fields in southern Iowa, not only on corn but also on soybeans. By the end of June, topsoil moisture content was rated at 96% adequate to surplus while subsoil moisture content was rated at 98% adequate to surplus. As was mentioned previously, subsoil moisture reserves can be crucially important in carrying the corn crop through the pollination period and into early grain fill. The wetter than normal conditions, however, raised concerns over the consequent development of shallower root systems and the potential detrimental effects that might arise should it turn warm and dry at or following pollination. These concerns, as we shall see, were well founded as the crop advanced into the reproductive phase of development. At the end of June, the USDA had reported that 75% of the Iowa corn crop rated in the "good" and "excellent" categories. This compared to 85% for Illinois, 80% for Indiana, and 68% for Minnesota.

Mid-Season

It was hoped that the month of July would bring some warmer and drier conditions, but only warmer weather would come. Heavy rains once again pummeled areas in north central and northeast Iowa. In addition, severe thunderstorms dropped softball-size hail in portions of Guthrie County. Floyd, Chickasaw, Mitchell, Worth, Butler, and Jones counties all received torrential rains over a two-week period, in some cases totaling in excess of 10 inches. The result was record flooding over portions of the Cedar and Shell Rock River basins.

Other areas of the state, however, experienced much drier conditions. The areas that did not receive the heavy rains were reporting that crops were looking good. Warmer weather moved across the state and gave a much needed boost to the development of the crop. Temperatures in the latter half of July soared into the 90s with a few locations reporting temperatures at the century mark or higher. The excessive heat began to make its mark, however, causing some stress symptoms to appear in the crops, especially those on lighter soils. Crops in the northwest and in the southern third of the state were showing signs of moisture/heat stress, not a welcome sight with pollination just around the corner. Here is where the subsoil moisture reserves from earlier in the season proved invaluable. Topsoil moisture was rated at 65% adequate to surplus, while subsoil moisture was rated at 75% adequate to surplus.

Silking pace by districts is presented in Table 5. Silking progress started at a slightly behind normal pace, but the warmer temperatures of late July helped speed the pace. Delays were most serious in the late-planted corn, as one would expect. By the end of the month, 92% of the corn acres across the state had silked, similar to last year's pace but about five days ahead of normal. Note Table 6 for a comparison of silking dates and the resulting average yields for the past five years. At the end of July, the USDA had reported that 70% of the Iowa corn crop was rated in the "good" and "excellent" categories. This compared to 56% for Illinois, 38% for Indiana, and 69% for Minnesota.

Table 5. 1999 corn silking progress by week for various crop reporting districts.*

	Percent of corn silked by			
District	July 18	July 25	August 1	August 8
NW	9	83	94	100
NC	2	63	91	97
NE	10	66	93	98
WC	7	76	96	99
C	21	84	97	100
EC	44	69	84	98
SW	24	80	94	98
SC	14	45	74	95
SE	18	68	90	97
State**	20/23	73/54	92/81	98/94

*Adapted from Iowa Agricultural Statistics Reports.
** Percent complete 1999/percent complete normal.

Table 6. A comparison of 1994 through 1998 silking pace of the Iowa corn crop.*

Silked by	1994	1995	1996	1997	1998	1999
July 10	10	---	---	---	---	---
July 17	52	---	---	---	---	18
July 20-24	82	14	4	11	49	71
July 27-31	98	60	42	70	84	90
Aug. 3-8	---	85	77	92	94	98
Aug. 10-15	---	96	93	99	99	100
Avg. Yield	**152****	**123**	**138**	**138**	**145**	**150#**

*Adapted from Iowa Agricultural Statistics Reports.
**Record.
#Estimated.

August brought some relief from the warm temperatures. Most areas of the state reported temperatures below normal for the first half of the month. Precipitation continued to be the topic of most concern. Areas of the state that had received heavy rains earlier in the season now were beginning to dry out and actually needing some rain. Other areas that were in need of a good shower got some sporadic rains but it may have been too little, too late. The warm temperatures combined with the lack of moisture in some areas helped to accelerate crop maturity. Even though accumulated heat units across the state were about normal, crop maturity was progressing slightly ahead of normal. The August crop report from the USDA forecast Iowa's corn yield at 151 bushels per acre. By the end of August, overall crop condition had held fairly steady totaling 70% good and excellent for Iowa, compared to 40% for Illinois, 34% for Indiana, and 63% for Minnesota.

Late Season

September brought a return to summer-like conditions. Discussions about the combined effects of warm temperatures and lack of moisture were prevalent. It was discovered that some fields in southern Iowa did not fair well during the pollination phase. The warm, dry conditions affected pollination, which resulted in poor kernel set and severely reduced yields. It was obvious that corn with a good root system on good soils with adequate soil moisture was doing the best. The USDA Crop Report for September rated Iowa's corn crop unchanged from the August report, at 151 bushels per acre. Many felt that this estimate was too high given the warm temperatures and extended dry period that much of the state had experienced.

The warm, dry conditions were favorable for the development of some foliar leaf diseases. Many areas reported heavy rust infestations, especially noticeable in fields where silage was being harvested. Concerns also were expressed regarding root and stalk rots that were evident in many fields across the state. By the end of the first week of September, 27% of the corn crop had reached a mature state (safe from frost). This is one day ahead of the 1998 pace and about five days ahead of normal (Table 7). With the accelerated maturity, concerns regarding early frost were essentially nonexistent. By mid- September, most of the state was experiencing unseasonably cool temperatures, averaging nearly ten degrees below normal. In the early morning hours of September 21st, a blanket of very cool air covered much of the state, resulting in widespread frost over the northern two-thirds of Iowa. Warmer conditions followed, however, with temperatures reaching the eighties just a couple of days later. The dry conditions persisted, also. The northwestern quarter of Iowa had received little if any measurable rain for several weeks. By the end of September, 95% of the corn crop was considered mature and safe from frost, roughly 11 days ahead of normal. Corn harvest began in earnest in late September (Table 8). Warm temperatures and high winds rapidly dried grain to less than 20% moisture in many fields.

Table 7. 1999 corn maturity progress by week for various crop reporting districts.*

District	August 29	Sept. 5	Sept. 12	Sept. 19	Sept. 26
	---------- Percent of corn mature by ----------				
NW	12	19	34	73	96
NC	4	25	41	74	95
NE	13	29	52	76	91
WC	2	23	41	69	96
C	6	28	60	91	99
EC	9	28	54	88	100
SW	4	18	46	80	98
SC	14	38	50	72	82
SE	9	45	65	86	96
State**	8/4	27/15	46/34	79/60	95/81

*Adapted from Iowa Agricultural Statistics Reports.
** Percent complete 1999/percent complete normal.

Table 8. 1999 corn harvest progress by week for various crop reporting districts.*

District	Sept. 19	Sept. 26	October 3	October 10	October 17	October 24
	---------- Percent of corn harvested by ----------					
NW	0	8	19	33	72	99
NC	3	6	16	31	55	98
NE	2	7	15	30	59	93
WC	3	6	20	27	50	96
C	8	14	23	40	72	99
EC	6	19	23	49	69	95
SW	2	8	14	29	46	94
SC	5	7	8	14	24	70
SE	4	10	21	39	53	85
State**	4/3	9/6	18/11	33/20	58/36	95/74

*Adapted from Iowa Agricultural Statistics Reports.
** Percent complete 1999/percent complete normal.

Following several days of unseasonably warm weather in late September and early October, reports of corn being harvested at less than 16% moisture began to surface. In central Iowa, dry grain and fair weather combined to speed harvest at a near record pace. The October crop report did show a small response to the warm, dry conditions. Corn yield was forecast by the USDA to average 150 bushels per acre. Early yield reports from across the state did lie in favor of this prediction.

The month of October began with much cooler than normal temperatures. A hard freeze hit northwest Iowa on September 29th and a very hard freeze followed on October 2nd. A light snow accompanied this over much of northwest Iowa. Warmer conditions returned by mid-month, but the dryness continued. Harvest progressed rapidly because of the ideal weather, but the dry conditions caused numerous combine and field fires in northwest, west central, and central Iowa. By mid-October, nearly three-quarters of the corn acres in central Iowa had been harvested; statewide, this figure approached 60% (USDA-NASS). Yield reports as of mid-October hovered around the average level, but given the drier harvest moistures, most producers were not too disappointed when realizing Mother Nature had taken care of the 1999 crop drying expense. Commercial grain storage was somewhat limited and a few grain elevators began piling corn on the ground to make room for the new crop.

By the end of October, corn harvest was all but complete in most areas of the state. Corn harvest was 95% complete across the state, which was two weeks ahead of the 1998 pace, and well ahead of normal. For the acres to be harvested yet this season, the challenge is to get the crop out of the field and into the bin before excessive field losses occur. Fall tillage and anhydrous ammonia applications had begun but were progressing slowly because of the extremely dry conditions. Average topsoil moisture was now rated 93% short and very short with no surplus. Average subsoil moisture had dropped to 86% very short and short and no surplus. Many producers expressed concerns about the need for some rain before the ground freezes this winter.

In summary, while the 1999 growing season had it's own unique characteristics, in many ways it resembled the 1998 season. Growing season weather, as usual, was a major player in the development of the crop. The lack of rainfall in the late season leaves much of the state in a precarious position as preparations for the 2000 season begin. Rains in the late season are necessary to recharge subsoil moisture reserves for the following season. November and December may bring some much-needed rains to the state, but if not, Iowa may be in line for drought-like conditions in 2000. Only time will tell.